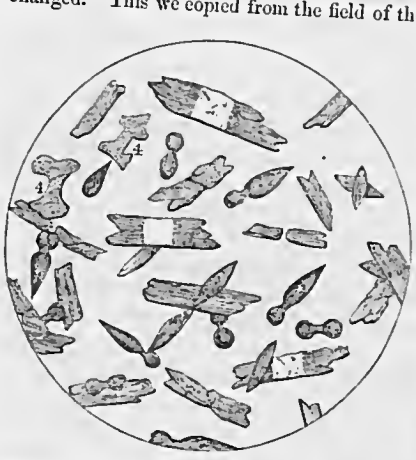
ART. II.—*Remarks on the Relation of the Dumb-Bell Crystals to Uric Acid.* By CHARLES FRICK, M. D., of Baltimore, Maryland. [With a wood-cut.]

THE pathology of oxalate of lime, and its relation to uric acid, are now so clearly understood, and so universally recognized, that it is needless at this time to enter into a particular explanation in regard to its formation; and we shall, therefore, take it for granted that, in ascribing its presence in the urine to deficient oxidation of the uric acid, we are assuming the correct explanation. Under the microscope, the most common form that this salt presents when it exists as a urinary deposit, is that of double pyramids united at their bases, or, as they are usually termed, octahedra; and these at first were the only recognized crystals of oxalate of lime. Dr. Golding Bird, however, in his work on "Urinary Deposits," first called attention to some peculiar crystalline bodies having more or less the appearance of dumb-bells, which he described as oxalate of lime, and which all observers subsequent to him have included under the same head. For many reasons, we were led to doubt the correctness of this opinion; and having had, as we think, an opportunity of satisfying ourselves in regard to their composition, we deem it a point in pathology of sufficient importance to allow of some brief remarks. It is true that the question might easily be settled by chemical analysis, but the infrequency of the occurrence of these crystals, and the minute quantity in which they are found, render this test impossible. We think, then, that these dumb-bells are not oxalate of lime, but that their presence may be accounted for by the disintegration of crystals of uric acid.

If oxalic acid and lime be added together, the crystals formed under these circumstances are always double pyramids, although at times so small as to be scarcely perceptible; and, however long the deposit be allowed to remain, neither dumb-bells nor ovals are ever found to make their appearance. Whereas, if a deposit, consisting entirely of uric acid, be carefully washed, and clear water added, we may discover, in a certain number of cases, after the lapse of a few days, that dumb bells are present, indicating, beyond a doubt, their formation from uric acid without the addition of lime. We were led to make this experiment from the following considerations:—We had frequently observed in a specimen of urine to which a small quantity of muriatic acid had been added, that, after standing a few hours, although crystals of uric acid only with a few epithelium scales and a small quantity of mucus were present, yet, after the lapse of some days, these same specimens would occasionally be found to contain dumb-bells, while the uric acid had either entirely disappeared or presented an amorphous appearance. We were thus shown that some relation existed between the dumb-bell crystals and those of uric acid, and that their formation was in all probability subsequent to the elimination of the uric acid by the kidneys. We then determined to take pure uric acid, or at least as pure as it could be obtained from urine by repeated washing,

and observe, under the microscope, the alterations that it underwent from day to day. By setting aside several specimens, and noting the changes that took place from day to day, we observed that, in the first place, the rectangular crystals had a tendency to become irregularly rounded off at their ends, afterwards to be fissured across near their centres in an oblique direction; and, finally, these two portions still adherent became rounded off in irregular steps towards the periphery of the figure; and this change we have remarked not once only, but on several different occasions. Should the crystals originally consist of rhomboids rounded off at their oblique angles, we may often observe that these first unite at their points—the two longitudinal axes being both in the same line—and then by the extreme points falling off, and these becoming, by degrees, irregularly rounded, they constitute a variety of the dumb-bell crystals in which the concavity of the sides is but slightly marked. Another, and, perhaps, the most common form of this transition stage, is where one end of the base is fully formed, as is also the union between the two, but the opposite head, instead of being round, is elongated to a point. More commonly, they are very irregular in shape, but still with resemblance enough to a dumb-bell to be sufficiently characteristic. The figures marked No. 4 in the wood-cut are of this variety. It is rare for more than one or two of these crystals, while actually in the transition stage, to present themselves at the same time under the field of the microscope. But within a few weeks past we have been fortunate enough to detect, in a specimen of uric acid put aside for this purpose, not only the dumb-bells in their formative stage, but also several fully formed, as well as some crystals of uric acid almost unchanged. This we copied from the field of the microscope, and is represented in the wood-cut that accompanies these remarks, with the exception of the two figures marked four, which were observed on another occasion; for without some such explanation the change we have just been detailing could not readily be understood.



Close attention will also enable us to observe that the ovals usually described as separate figures from the dumb-bells, are in fact identical with them; the apparent difference being in reality due to the different planes in which they are seen. Some of these are transparent dumb-bells, with a very slight concavity at the sides surrounded by an oval, the interval between the two being filled up

with a black space; while others, again, appear to be dark ovals with a small transparent square set in the middle. If these are made to revolve on their short axis, it will be seen that one face presents an oval, while a section made at right angles to this is a true dumb-bell. Both these forms, if the deposit is of any size, are usually seen together, but occasionally one only presents itself.

We are unable to speak with certainty as to the original shape of the uric acid crystal which determines the subsequent formation of dumb-bells, but are of the opinion that, in a majority of instances, the rectangle, with a height nearly equal to its base, more than any other form, is most liable to this transformation. They are seldom if ever observed at the time of micturition, and are in fact very rarely seen. Of the many hundred abnormal specimens of urine presented to us during the last few years for examination, we do not remember to have seen them but on four occasions, and in each one of these the urine had been voided twenty-four hours previously.

In his description of these figures, Dr. Bird states that "they are produced in all probability by a prolific arrangement of minute acicular crystals" (of oxalate of lime). But this we think cannot be the case. There can be no lime entering into their composition, for we have shown that their formation takes place when there is none of this substance present; but at the same time we must acknowledge our inability to explain the exact process that goes on. It would seem, however, from the changes exhibited under the microscope, that this result is one of simple disintegration. All crystalline bodies made up of organic elements have a tendency, by exposure to air or water, to lose their clear, distinct outline and sharp edges, and to become amorphous; and, in all probability, crystals of uric acid of a peculiar shape have, under circumstances which we cannot yet explain, a tendency to break up and agglomerate in certain forms, more or less referable to dumb-bells.

In connection with this subject, we may mention here a change somewhat analogous that occurs in the crystals of the triple phosphate. The phosphate of magnesia and ammonia, or, as it is more commonly called, the triple phosphate, occurs in the urine under two different forms, one stellar and the other prismatic; and, although both of these present an endless variety of crystallization, yet both may be included under one or the other of these heads. This difference has been heretofore explained by calling the one a monobasic, and the other a deutobasic salt, under the supposition that twice the quantity of ammonia was combined in the last in proportion to the other. Our friend Dr. David Steuart, of this city, however, has lately called our attention to the fact that these crystals may be formed, one from another, by simple aggregation. He succeeded in depositing them from the same specimen in both forms, and also in crystalline shapes intermediate between the two. This he effected by making an acid solution of the phosphate of ammonia and magnesia, and then adding very cautiously a drop of ammonia. This precipitates the phosphates immediately at the surface, a portion of which fall to the bottom

of the glass to be again redissolved. The upper stratum is, after a time, gently shaken, when more crystals fall with the same effect. There is a point, however, if the solution is not too acid, or sufficient ammonia has been added, when some of these crystals remain undissolved, and by carefully setting aside the tube at this stage, and allowing it to remain undisturbed for some time, we may detect, by the microscope, both the prismatic and stellar crystals with their intermediate stages. This experiment we have repeated, and are able to substantiate his opinion in regard to the mode in which these formations occur. Most of the stellar crystals are of two varieties; the first being composed of four rays, and the second of six. In the first we usually find, during this process, that, by aggregation of crystalline material, two prisms are formed which intersect each other at right angles; or else two of the rays which are in the same line become elongated, and material is gradually deposited in the interstices to make up a single perfect prism, the two long arms corresponding to the length, and the two short to the breadth of the crystal. In the second variety, where the figure has six rays, four of these become elongated in a similar manner, and the same deposition occurs as in the other; or else these rays are all joined together at their extremities, and the figure then filled up constitutes one variety of the prismatic crystal which is very frequently observed. These crystals, then, are not dependent upon the difference in proportion of ammonia in the two, but merely to the rapidity with which they are formed; nor is the stellar variety, as has been heretofore stated, indicative of a severer lesion than the other. We ourselves have never seen these stellæ already existing in urine at the time of emission, nor have we ever observed them to occur spontaneously.

The relation of these two forms of phosphate to one another seems to us a very interesting point in urinary pathology, and we are of the opinion that many of the crystals found in this secretion, heretofore considered as differing from one another in their chemical composition, will be found a more accurate observation to be formed either by the aggregation or disintegration of primitive crystals.

Baltimore, *May* 10, 1850.

Art. III.—*Extracts from the Records of the Boston Society for Medical Improvement.* By Wm. W. Morland, Secretary. (With a wood-cut.)

Feb. 11.—*Melanosis of the Eye.*—Dr. Bethune reported the following case. The patient, a healthy farmer, sixty-five years of age, entered the Eye and Ear Infirmary under his care. Twenty years ago, he first observed a red spot at the outer angle of the left eye, wedge-shaped, and with the apex towards the pupil, as in pterygium. For fifteen years it was stationary; but five years ago it began to grow, and at the end of one year he was only able to discern